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J. Parallel Distrib. Comput. 66 (2006) 487–488
Journal of Parallel and Distributed Computing
www.elsevier.com/locate/jpdc

Foreword

Special issue: Algorithms for wireless and ad-hoc networks

Very few of us can imagine our lives without cellular phones and, more generally, without pervasive connections. But all of us (including those few who remain cool) are attracted by all the challenging algorithmic problems involved in obtaining connections anywhere and at any time. New levels of complexity, not present in the algorithmic design for wired networking, emerge. Indeed, the algorithms must optimize the use of scarce resources such as bandwidth and battery power, must deal with unreliable wireless channels as well as selfish and sometimes Byzantine partners, and must commute from one wireless system to another in a way transparent to the system users. In the above scenario, the complexity has been tamed using new clever algorithms, which are often based on those that are already part of the foundations of computer science.

This special issue brings together research contributions on the design, specification, and implementation of discrete, approximate, optimization, and distributed algorithms for current and future wireless ad-hoc and sensor networks. Of the more than 30 papers, both theoretical and practical, that were submitted, the 11 papers discussed below were selected for publication. These papers do not cover all aspects that belong to the scope of this special issue. However, they represent interesting research efforts and subjects that definitely belong to the core research on algorithmic solutions for ad-hoc and sensor networks.

The first six papers address issues raised in ad-hoc networks. In their paper "Assign Ranges in General Ad-Hoc Networks," J. Chlebíková, D. Ye, and H. Zhang describe the Minimum Range Assignment problem in static ad-hoc networks where the transmission distances can violate triangle inequality, providing probabilistic and approximation algorithms. In "Fast Distributed Algorithm for Convergecast in Ad Hoc Geometric Radio Networks," A. Kesselman and D. Kowalski provide a randomized distributed algorithm for the convergecast problem, that is, the problem of collecting in a single node data from all the nodes of the network. In the next paper, "Simple Approximation Algorithms and PTASs for Various Problems in Wireless Ad Hoc Networks," X.-Y. Li and Y. Wang consider intersection graphs that model the wireless network, and they provide a heuristics and polynomial time approximation scheme to solve problems that may occur in interference-free channel assignment or scheduling. With "Greedy Localized Routing for Maximizing Probability of Delivery in Wireless Ad Hoc Networks with a Realistic Physical Layer," J. Kuruvila, A. Nayak, and I. Stojmenovic present greedy, localized routing algorithms that maximize the probability of delivery, without acknowledgments, in a realistic physical layer. In "Efficient Management of Transient Station Failures in Linear Radio Communication Networks with Bases," C. Gaibisso, G. Proietti, and R.B. Tan provide swap algorithms to guarantee survivability under transient station failures given an optimal range assignment for a set of stations spread on a line. Finally, S. Shivle et al. in "Static Allocation of Resources to Communicating Subtasks in a Heterogeneous Ad Hoc Grid Environment" present a heterogeneous computing and communication system that allows a group of mobile devices to accomplish a mission, often in a hostile environment.

The remaining five papers deal with topics concerning sensor networks. In their paper "Maximum Lifetime Data Sensing and Extraction in Energy Constrained Networked Sensor Systems," B. Hong and V.K. Prasanna focus on data gathering problems in energy-constrained networked sensor systems, proposing optimal algorithms based on network flows and heuristics based on self-stabilizing spanning trees and shortest paths. In "A Fast Localized Algorithm for Scheduling Sensors," G. Calinescu presents approximate, randomized, localized algorithms for the domatic number problem which models that of monitoring targets on a curve with a sensor network. In the next paper, "Wireless Ad-Hoc Lattice Computers (WAdL)," V. Gupta, G. Mathur, and A. Shende present the design and algorithms of the WAdL architecture, which has the ability to maintain, despite the mobility of the participating devices, a virtual lattice where the devices represent lattice points.

Finally, the last two papers devise routing protocols for sensor networks. In "Fault Tolerant Wireless Sensor Network Routing Protocols for the Supervision of Context Aware Physical Environments," A. Boukerche, R.W. Nelem Pazzi, and R. Borges Araujo present a periodic, event-driven and query-based protocol, along with its hierarchical version, and evaluate its performance on several scenarios. In "A Rule-Based Adaptive Routing Protocol for Continuous Data Dissemination in WSNs," D.F. Macedo et al. design and evaluate a protocol for continuous data dissemination networks that interacts with the application to establish routes.

doi:10.1016/j.jpdc.2006.02.001

The guest editors thank all the referees for their valuable comments and suggestions and all the authors for their high-quality submissions. Special thanks go to the editor-in-chief of JPDC for hosting this special issue.

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